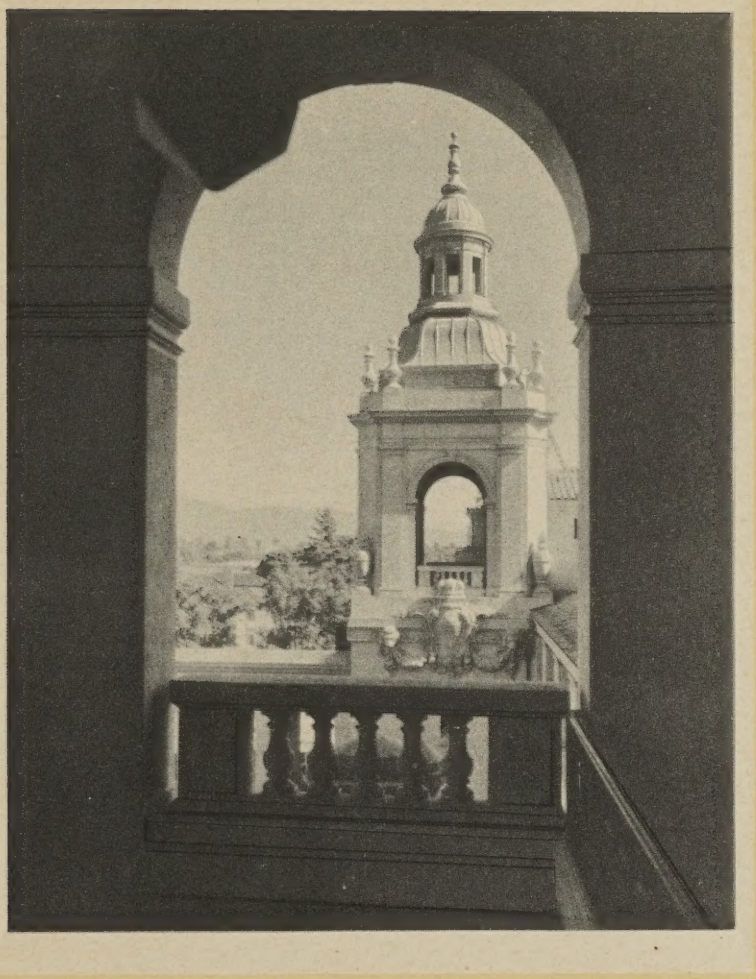

MONOLITHIC CONCRETE BUILDINGS

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FOREWORD

FOR several years it has been the practise of many Pacific Coast architects to construct large buildings, including the walls and architectural ornamental detail, entirely of reinforced concrete. This type of construction is adaptable, not only to large buildings, but also within a wide range, to buildings of any size and utility. The purpose of this brochure is to point out the inherent architectural beauty of this type of construction, and its adaptability and application to a wide variety of buildings.

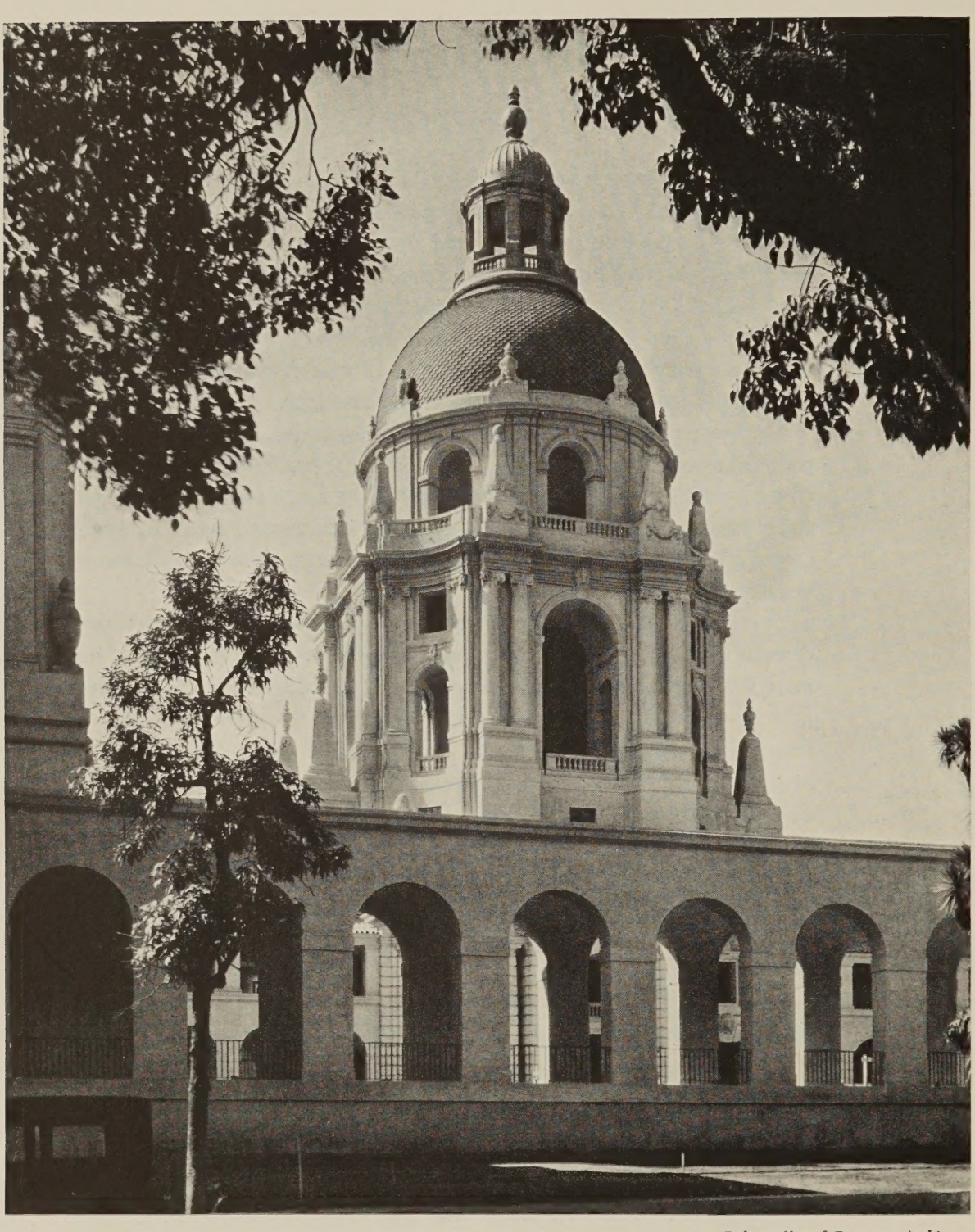
The construction consists, essentially, of the erection of a reinforced concrete frame of any height, enclosing the frame at practically the same time with monolithic walls. In this class of work the forms for the walls are so constructed as to include practically all of the architectural detail and ornament. When the forms are removed there remains a monolith of enduring beauty.

There is an architectural beauty inherent in concrete. Architects have come to realize this — and have ceased to use it as an imitation of other materials. Concrete needs no apologies as a material for artistic or architectural rendition. Thoroughly within true artistic sense, and without overstepping the bounds of the concomitant architecture, monolithic buildings may be designed to meet the most exacting demands of harmony with any surrounding architectural condition. It is a plastic material, which the creator will find pliable in his hands to meet his ideas of beauty and symmetry.

Concrete for such buildings must be scientifically designed, and placed with proper engineering supervision. Arbitrary mixes that have been used in the past, must give way to more up-to-date methods in concrete design. Mixtures designed for durability and with workable consistencies under the principles of the water-cement ratio law, make possible the achievement of monolithic construction of buildings in an individual architectural type.

Concrete is a building material second to none, and far superior to many now used. It can be molded or carved, stained or colored, and given any texture desired. With the use of colored aggregates, and their subsequent exposure, the color of concrete may be varied as desired, fully within a range equivalent to the natural colors of stone.

Because it possesses structural strength, natural resistance to fire and water, and decorative possibilities, concrete may be classed as a complete building material.



Bakewell and Brown, *Architects*

DOME OF CITY HALL, PASADENA, CALIFORNIA

MONOLITHIC CONCRETE BUILDINGS

THIS age of concrete and steel has brought to architects new advantages and new opportunities. So rapid have been improvements in materials and construction methods that from the viewpoint of the historian of coming generations the present era will appear as one in which a succession of worthy architectural developments took place. Chief among these will be recorded progress in the use of concrete in monolithic walls.

A construction method has been developed in the past decade which gives the architect the opportunity of using one plastic, versatile material — concrete — throughout an entire structure to meet all decorative as well as structural requirements. Monumental buildings have been erected in which the walls, floors, structural frame and decorative exterior and embellishments are of concrete alone. This has permitted an architectural unity that has never before been achieved. It has created a new field of architectural design having infinite possibilities and uses.

The design and erection of monolithic concrete buildings in this manner has passed through the experimental stage, as hundreds of excellent structures testify. The rapidly increasing number (spreading now to all parts of this country) indicates that past successes are prompting further use. It is to indicate the possibilities, as yet barely touched, of the monolithic type structure that the text and photographs of this book are dedicated.

NEW STYLES IN MONOLITHS

The monolithic type, or as some architects prefer to call it, the ferro-concrete type, is characterized by solid walls, clean-cut lines, long pilasters which carry the eye from ground to sky line, and interesting bas-relief work, for the most part cast-in-place. Essentially the structures are one hundred per cent monolithic; that is, the columns, walls and floors are cast as a unit, the forms being built so as to include practically all of the architectural details and trim, as the work progresses. The design combines a frank structural expression with an exterior treatment that is perfectly natural to the material and the structural form.

BASIS FOR THE DESIGN

Buildings having exterior walls of monolithic concrete have been used for industrial purposes for many years with success from a structural although not always an æsthetic point of view. It was the problem of the architect to take the sturdy, efficient structure of this type as a foundation from which to develop a design for office buildings, hotels, schools, churches and monumental public structures. This has been done with particular success on the Pacific Coast where, from Seattle to San Diego, may be found striking buildings of monolithic concrete. In England, France, Germany and many of the South American countries this practice of using concrete as the complete building material has existed for many years, and many remarkable structures of this type have been erected.

It is an interesting fact that each age has surrounded itself with a type of architecture which is characteristic of the principal material available at the time. No other material can be secured so readily and in such abundant quantities in any part of the world as concrete. Other economic conditions are having a part in creating the monolithic type. One of these is the cost of construction and of construction materials which has placed a certain restraint upon the manner in which buildings shall be erected. The simple facade of our office buildings with its straight lines and minimum of architectural treatment is due somewhat to

the high cost of carving and setting ornamentation. The designer has been forced to reduce architectural embellishments to a minimum. The fact that such ornamentation can now be produced in concrete at a low cost is changing the situation, for although the use of proper ornamentation has been greatly reduced, the desire of architects and of their clients for a proper amount has not. The first copy in concrete of the original model costs practically the same as if carved from stone. When reproduced once in concrete, this cost is cut one-third; after four or five repetitions it is reduced so greatly that the decorative treatment ceases to be a serious item of expense.

The use of plastic workable concrete which may be molded and formed in place is largely a modern development. Not the idea, certainly, for mud, clay, mortar and various early cements such as those used by the Romans have long been known. But the use of present day reinforced concrete which has both compressive and tensile strength is modern. Walls of surprising thinness, staircases apparently hanging in air, and similar architectural developments which have been made possible by reinforced concrete, are still a trifle shocking to the individual who continues to think in terms of the construction materials of centuries past.

TODAY'S CONCRETE

Scientifically made concrete, replacing the old "1-2-4 mix" for every purpose, is the great factor which makes possible the new styles in monolithic structures, with their intricate embellishments cast in place. Today the average intelligent mechanic can place in the hands of the architect and engineer a concrete that will fulfill his requirements as to faithful reproduction of design with an assurance that it will withstand the elements at least as successfully as any other material within the economic limits of the design. The architect can accept the concrete of today as a material having quality and integrity equal to any other material he is now employing.

A great deal of heretofore laborious mathematical work involved in the design of reinforced concrete has been eliminated or simplified, and shorter and more practical methods standardized. Both the quality of concrete and the theories of design involving its use have been subject to intense critical study in the past decade, and the knowledge gained by this study makes possible a new quality of workmanship. This is exemplified by the monolithic structures of the Pacific Coast, which furnish a large part of the illustrations in this volume.

"A MONOLITH WHICH HAS ARISEN FROM THE GROUND"

Certain qualities which contribute to the success of the monolithic structure may well be considered at this point. The dominant note should be that of the monolith which has arisen out of the ground upon which it stands. It should leave the impression that it has always stood there, and like the great Redwoods, produce a picture in the mind of the observer of a sturdiness sufficient to combat the elements for centuries. There must be a complete harmony between exterior treatment and structural form, and both must be in keeping with the nature of concrete itself. Here the architect has an opportunity to work out a complete sympathetic treatment of structural form and exterior embellishment, for one material serves both purposes.

It is possible, the accompanying illustrations will show, to adapt concrete and the monolithic type of construction to practically any architectural period design. Whether this is desirable is a question the individual architect must decide. He will do well to consider that he is handling a plastic material different from any other of the past. He may find, as many have, that the monolithic type is best expressed

through a form which is not in complete conformity with any particular classification. A large number of buildings on the Pacific Coast have had as their basis an early American mission architecture which has been so modified that it would be difficult to classify. The Los Angeles Library, the last great work of Bertram G. Goodhue, is a notable example. Structures of this type rely for their beauty on their sense of mass, strength, immovability. They are characterized by rectangular lines, occasional large unbroken wall areas, deep set windows and massive entranceways.

Frank expression of those qualities of ruggedness and strength which are characteristic of concrete is the most successful design method. Long vertical lines, massive columns and graceful arches lend themselves most easily to expression in the material. The parabolic arch, with its dynamic, changing curvature may be used with particular effect.

NEW TREATMENT OF MONOLITHIC EXTERIORS

Given a structural design in keeping with the nature of the material, the next important consideration is the exterior surfacing. The method of treating the monolithic wall will of course depend upon the effect the architect desires to produce. In the structures illustrated in this volume are a number of the more common methods, but the field has hardly been touched, so many are the effects that may be achieved in concrete and stucco.

Possibly the most interesting, because of the boldness of the style, has been the practice of leaving the concrete exterior just as it comes from the forms. The rugged character of the material is emphasized and an individuality given to the structure which is unique to this type. Excellent concrete and careful form work make it possible for the designers to achieve artistic results in this manner which a few years ago would have been thought quite impossible. Surfaces to be so left must be detailed carefully, and specifications must call for the best grade of tongue and groove lumber of size in keeping with the dimensions or design of the building. Recommendations for form work, concrete mixtures and stucco preparations are given later in this book.

Many notable monolithic structures using the exposed form mark method just described have been given a slight added treatment by grinding down the concrete surface to remove projections, giving the exterior a smooth appearance. This grinding should not remove the form marks, for they are an essential part of the decorative scheme, but it does remove slight irregularities which might prove displeasing. A step further in this direction is taken by the application of a cement paint, cement wash or stucco coat. These treatments serve to dress up the exterior without totally destroying the rugged character of the surface.

ACCOMPLISHMENTS IN STUCCO

Application of stucco in pure whites, creams and varied colors to the monolithic walls make it possible to develop a remarkable variety of architectural effects at low cost. On the Western Coast, from Washington to California, where climatic changes and moisture are often unusually severe, this method of treating the surface of monolithic concrete structures has proven entirely satisfactory. Good workmanship in the application of the stucco has proved to be a more important factor than climatic conditions. Stucco surfaces, properly prepared and bonded to the concrete have proved just as adaptable to the changing climates of Chicago and New York as to those of Florida and California. Suggestions for the application of stucco to monolithic concrete will be found in another section of this book.

Single coats of stucco, as explained above, are often used to diminish the coarse appearance of the surface without destroying the character achieved through the form pattern.

Such treatments may consist of applying a thin, colored stucco to the wall or dashing the surface and allowing it to harden as the final finish. In either case the form marks will not be entirely obliterated.

Two and three-coat stucco is more commonly used, and offers a wider range of textural and color effects. In the three-coat stucco broken ashlar or marked-off stone effects can be achieved that are interesting and effective. The finish of the separate stones is often varied in color-tone to produce mottled effects, or unique results may be achieved by combing the blocks with a stiff wire brush, alternate blocks at right angles to each other. The multi-coat work also makes possible the use of sgraffito designs. In addition there are offered the varied effects possible through a wide range of trowelled treatments.

MOLDED DECORATIONS

The most remarkable advantage gained through use of the monolithic wall structure is the fact that architectural decorations and embellishments may be cast as an integral part of the wall or column and at the same time as the member is cast. This is accomplished through use of waste molds (inexpensive molds of plaster of paris, which are discarded after using once) built into the wood forms and filled with the same concrete as the rest of the structure. When the walls are complete, all of the architectural decoration is in place, thus saving the additional cost of building scaffolds and setting stone.

Molded decoration, as this may properly be called, offers the widest possible range of treatment of architectural ornamentation. The most minute details in columns, flutes, bas-reliefs or panel surfaces may be carried out. The fact that the same mold may be easily copied makes it simple to repeat a given ornamental design many times, as has been previously pointed out, without materially increasing the cost. The ornamentation may be given the same surface treatment as the walls and other parts of the building or it may be colored, brushed, bush hammered, or otherwise finished.

WALLS FUNCTION AS STRUCTURAL MEMBERS

Reinforced concrete walls, because they are an integral part of a truly monolithic structure, function with the other structural parts and may be utilized as such. They are active in resisting horizontal stresses and tend to tie the structure together, a quality particularly desirable in localities where wind storms or earth shocks are an ever-present menace. The monolithic wall may be used to take up part of the wind stress, thus making it possible to reduce the size of other structural members. It is a type of construction which gives greater stability without greater cost; in fact, it can be fairly demonstrated that the monolithic wall type structure can usually be erected at a considerable saving over other comparative types and at the same time offer greater strength, permanence and rigidity.

One of the factors which reduces cost is the decrease in thickness of walls made possible by concrete. Practically all building codes which require a masonry filler or panel wall to be at least 12 inches thick, permit a concrete wall in similar location to be only 8 inches thick. On this basis, the cost per square foot of wall area will favor concrete. Since the concrete wall also acts as the final exterior finish, the load on footings is further reduced by the elimination of weighty facing materials. So many factors enter into the cost of buildings that it is difficult to draw comparisons between types; however, figures and cost comparisons on a large number of structures — enough to furnish a basis for a reasonably accurate statement — show that there is a marked saving in the use of this type of construction.

Another desirable feature of the monolithic structure which helps reduce costs is the use

of the concrete beams, girders and other structural members inside the building as part of the architectural or decorative scheme. Stains and paints may be applied directly to the load bearing members, giving a dignity and frankness of expression not possible with any amount of superficial ornamentation. This feature has been particularly well demonstrated in the treatment of lobbies and lounging rooms of hotels and clubs, interiors of theatres and elevator lobbies of large buildings. Stenciled designs on ancient walls and ceilings, sacred to the architect and artist, may now be revived and placed in our modern buildings with an assurance that they will be at least as permanent as the ancient examples from which they were drawn—and this at an entirely moderate cost to the owner.

The new styles in monoliths open a new field in building decorations, both interior and exterior. The modern high-quality, low-absorption concrete exercises no restraint upon the architect. On the contrary, this material offers a greater freedom in design than any other. It has the enduring characteristics of stone; it can be molded and fashioned to any form; it can be finished with any color or texture desired. In short, it possesses the three great qualities necessary to a universal building material—structural strength, fire and weather resistance and decorative ability. Nothing about the monolithic type is more appealing than the fact that it is so elastic, varied and interesting. It calls for more intensive study, thoughtful consideration, and exercise of true artistic merit than the older architectural forms, but in the hands of the imaginative, versatile architect, it offers new possibilities for noble and lasting achievement.

Bakewell and Brown, *Architects*

CITY HALL, PASADENA, CALIFORNIA

The decorative details are skilfully carried out with a combination of precast and cast-in-place concrete.

Bakewell and Brown, *Architects*

CITY HALL, PASADENA, CALIFORNIA

Precast detail, set before the wall was stuccoed. An excellent example of the work of the designer, reproduced in concrete.

Bakewell and Brown, *Architects*

CITY HALL, PASADENA, CALIFORNIA

Reinforced concrete walls, finished with buff stucco. All ornamentation in concrete, either precast or cast-in-place.

"Each historic epoch or style will yield inspiration to the student who earnestly seeks to impart something of his own, of himself, to a design for execution in a new material.

"This is exactly what has happened, and is happening more and more widely, in the use of concrete as an exposed building material, with a number of architects in California whose work can safely be called successful. So far, fundamental conceptions of satisfactory proportions have been violated hardly at all, although the special characteristics of concrete have been frankly recognized. As a matter of fact, the flexibility of a material which lends itself not only to broad surfaces but to highly ornamented areas as well, fitted it exceptionally to the style which can now fairly be called 'Californian.' Based on the traditional and appropriate Spanish-Colonial architecture of early California and Mexico, and finding much of congenial inspiration on the Mediterranean shores of Italy, France, Spain, Africa, it has become a law unto itself."

HARRY C. ALLEN

Journal of the American Institute of Architects
October, 1928

Robert H. Orr, *Architect*

WILSHIRE BOULEVARD CHRISTIAN CHURCH, LOS ANGELES, CALIFORNIA

Built entirely of reinforced concrete. Impressions of the wooden forms remain as the exterior treatment for the main part of the church and campanile. All ornamentation except the rose window and arch panels above entrance doors was cast in the structural concrete.

Robert H. Orr, *Architect*

WILSHIRE BOULEVARD CHRISTIAN CHURCH, LOS ANGELES, CALIFORNIA

Main entrance facade. All decorative detail, except the rose window and arch panels above the doors, was cast-in-place. The architect's details have been carefully worked out by means of waste molds which were a part of the wall forms.

Robert H. Orr, *Architect*

WILSHIRE BOULEVARD CHRISTIAN CHURCH, LOS ANGELES, CALIFORNIA

Entranceway at the base of the campanile. This entire entrance, except the semi-circular panel above the door, was cast-in-place and of the same concrete as that used in the walls. The ornamental details have been faithfully reproduced.

Allison and Allison, *Architects*

FIRST BAPTIST CHURCH, LOS ANGELES, CALIFORNIA

Lines, and careful forming, produce the final architectural effect. All ornamentation, except the rose window, was cast in the structural concrete. The rose window was precast.

Allison and Allison, *Architects*

FIRST BAPTIST CHURCH, LOS ANGELES, CALIFORNIA

Surface details of concrete walls, and cast-in-place decoration.

Allison and Allison, *Architects*

FIRST BAPTIST CHURCH, LOS ANGELES, CALIFORNIA

A view along the side of the church showing how carefully all details have been carried out in monolithic concrete. The width of the form boards plays an important part in the final effect.

Allison and Allison, *Architects*

FIRST BAPTIST CHURCH, LOS ANGELES, CALIFORNIA

Another view of the side of the church showing the manner in which interesting details have been carried out in this structure.

Harold Cross, *Architect*

ARLINGTON AVENUE CHRISTIAN CHURCH, LOS ANGELES, CALIFORNIA

The large wall areas without windows and without decoration give the desired architectural effect. Subdued form marks lend interest and charm to the surfaces.

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July 2, 1929

Dear Sir:

The booklet "Monolithic Concrete Buildings," which accompanies this letter has been prepared to illustrate the use of an age-old material in expressing new thoughts and ideas of current architecture.

Concrete is capable of almost any feat in construction, but some of its most notable exploits from the architectural point of view are to be found in monolithic buildings. "Monolithic" as used here refers to concrete molded in place for walls, structural frame and decorative detail of buildings, resulting essentially in a structure cast in one unit. This type of construction results in a frank structural expression with an exterior treatment that is perfectly natural to the material - truly a Concrete Architecture.

Developments in construction methods, accompanied by wide research in the art of making durable concrete, have made concrete a complete building material. Architects and engineers, in taking full advantage of these developments, find a plastic material with which to work, and one which will allow the exercise of real ingenuity in design and construction. The problem is not difficult, and the flexibility of the material combined with certain economies that accrue will have a definite appeal in the application of this method to architecture.

The last paragraphs of this booklet contain practical recommendations that should tend to simplify original problems by explaining the methods by which this type of building has been developed. While the photographs used in this publication are mostly of buildings in the western United States, the same type of construction may be successfully employed in any location with the assurance that the structure will endure as well as or better than any other building material now in use.

The Portland Cement Association maintains offices in 32 principal cities and each office has an engineer who will be glad to assist you in any problem encountered involving the use of concrete. Your inquiries will be given prompt attention.

Yours very truly,

W.E.Hart

W.E.Hart*MCB
enclosure

Manager,
Structural and Technical Bureau

Harold Cross, *Architect*

ARLINGTON AVENUE CHRISTIAN CHURCH, LOS ANGELES, CALIFORNIA

Almost any type of architectural treatment, however complicated or simple, may be carried out in concrete.

Allison and Allison, *Architects*

WILSHIRE BOULEVARD CONGREGATIONAL CHURCH, LOS ANGELES, CALIFORNIA

The first architecturally important structure of concrete without a facing material. Considered a daring experiment, it aroused such admiration as to create a demand for similar use of concrete for other notable buildings. Decoration and trim cast-in-place, except the precast rose window, from the same concrete as the walls, columns, and floors.

Walker and Eisen, *Architects*

NATIONAL BANK OF COMMERCE, LOS ANGELES, CALIFORNIA

Portland cement stucco and cast stone in the same color have been used in the ornament and walls of this bank entrance. Carefully drawn detail has been preserved in all of the ornaments through the use of plaster molds. Color employed in the structure makes it a distinctive building on this busy thoroughfare.

Stairs to upper terrace as seen through one of the arches of the arcade on the street side.

EBELL CLUB,

Concrete has been used
in this study club for
Angeles. It consists of
theatre, or playhouse,
The exterior walls are
with the form marks sh
tation is cast in the str
architecture is Italian i
impression of a large
garden and patio. The
complete club facilities.

Hunt and Burns, *Architects*

LOS ANGELES

as a complete material
r the women of Los
a main building and a
connected by a patio.
of monolithic concrete
howing. All ornamen-
uctural concrete. The
n spirit and gives the
mansion built around
nain building includes

Tea room
loggia.

Curlett and Beelman, *Architects*

ELKS' CLUB, LOS ANGELES, CALIFORNIA

Characteristic of the strength and dignity that may be obtained through the use of monolithic concrete. Finished in cement stucco applied directly to the concrete walls.

Curlett and Beelman, *Architects*

ELKS' CLUB, LOS ANGELES, CALIFORNIA

Main entrance facade. All decoration molded in place, integrally with the concrete of the walls.

George C. Nimmons and Company, *Architects*

SEARS ROEBUCK & COMPANY, LOS ANGELES, CALIFORNIA

An industrial building constructed entirely of reinforced concrete. Through simple, straight lines the architect has produced a very effective tower for this type of building. Vertical lines accentuate the height and add interest to the whole.

George C. Nimmons and Company, *Architects*

SEARS ROEBUCK & COMPANY, LOS ANGELES, CALIFORNIA

A massive but simple entrance as expressed in concrete adds strength and dignity to the structure. The ornamentation was cast in the structural concrete and the entire building given a finish of ivory-colored portland cement stucco.

Arthur E. Harvey, *Architect*

AMERICAN STORAGE COMPANY, LOS ANGELES, CALIFORNIA

The vertical lines and use of ornament give this warehouse a style suitable for any business district. The rustication and exterior finish has been produced by lining the wood forms with a special non-warping board. All ornamentation has been produced in the structural concrete through the use of waste molds.

Arthur E. Harvey, *Architect*

AMERICAN STORAGE COMPANY, LOS ANGELES, CALIFORNIA

A portion of the building above the main parapet. This decoration was made by assembling waste molds of plaster of paris and filling them with the structural concrete. The window traceries are precast concrete.

John Reid, Jr., *Architect*

WEST PORTAL SCHOOL, SAN FRANCISCO, CALIFORNIA

Many of the schools in San Francisco are built with all enclosing walls of reinforced concrete decorated by means of cement finished in color and concrete ornamentation. Schools on the opposite page have employed the same construction except for the ornamentation.

THE FRANCISCO SCHOOL AND THE COMMERCE SCHOOL,
SAN FRANCISCO, CALIFORNIA

Typical examples of the many large concrete school buildings in San Francisco. Permanent school structures should be built of fireproof materials throughout as required in that city.

Dodd and Richards—Carleton M. Winston—Reginald D. Johnson—Roland Koate—Witmer and Watson, *Architects*

ARCHITECTS' BUILDING, LOS ANGELES, CALIFORNIA

Typical of the monolithic construction shown in this book as the building appeared immediately after the forms were stripped. The finish, better illustrated on the opposite page, was obtained by grinding the surface to remove irregularities, but not the form marks. All ornamentation, including the balconies, was cast in the structural concrete.

Dodd and Richards—Carleton M. Winston—Reginald D. Johnson—Roland Koate—Witmer and Watson, *Architects*

ARCHITECTS' BUILDING, LOS ANGELES, CALIFORNIA

How well concrete can be used for insized ornamentation is shown in this entrance. The pleasing effect of the wall finish is seen above the entranceway.

Lee Callahan and Sons, *Architects*

ENTRANCE, LANGHAM APARTMENTS, LOS ANGELES, CALIFORNIA

Interest and refinement were built into this entrance by using concrete as a complete material. Rustication was produced by nailing small beveled strips to the front form.

Curlett and Beelman, *Architects*

ENTRANCE, PACIFIC COAST CLUB, LONG BEACH, CALIFORNIA

A dark brown stucco marked into broken ashlar has produced an outstanding building in Long Beach.

Harry E. Werner, *Architect*

BEVERLY PROFESSIONAL BUILDING, BEVERLY, CALIFORNIA

The vertical lines of this structure are accentuated by the ornamented spandrels cast in the structural concrete. Monolithic concrete construction is particularly appropriate for the perpendicular style of architecture.

Harry E. Werner, *Architect*

BEVERLY PROFESSIONAL BUILDING, BEVERLY, CALIFORNIA

The entrance is given added interest by the care used in casting and staining the decorative spandrels. After the waste molds were withdrawn the concrete was stained a bronze color. The same process was used in the second-story belt course and the parapet wall.

M. I. Biggs, *Architect*

LAKESIDE APARTMENTS, OAKLAND, CALIFORNIA

Monolithic concrete may be applied to all types of structures. The style of architecture for this building does not differ from that used in any part of the country. The walls were finished with a cream-colored stucco.

Morgan, Walls and Clements, *Architects*

HOLLYWOOD PAPER BOX CORPORATION, HOLLYWOOD, CALIFORNIA

Factory buildings and warehouses may enhance property values for any community if the style of architecture is pleasing. In this structure the architect has combined the use of monolithic walls treated with a cement finish and ornamentation cast in the structural concrete.

Harbin Hunter, *Architect*

CITY NATIONAL BANK, HUNTINGTON PARK, CALIFORNIA

A frank expression of the material with which the building is constructed. The massive front is symbolic of the strength necessary to guard the contents of the building.

Harbin Hunter, *Architect*

CITY NATIONAL BANK, HUNTINGTON PARK, CALIFORNIA

Exposed concrete has been used for the interior as well as the exterior of this bank building. The concrete beamed ceiling has been stained in many colors on a dark background.

Concrete Mixes.—Monolithic walls that enclose a building must be constructed of concrete of such quality as will resist the destructive agencies of seasonal changes and at the same time be sufficiently economical to make the completed structure attractive as an investment. The most important factor affecting the durability of concrete exposed to severe weathering is its watertightness. Therefore, the concrete must be made of non-porous, durable aggregates thoroughly incorporated in a watertight cement paste.

Experience has shown that a watertight paste may be made by limiting the amount of mixing water to 6 gallons per sack of cement which includes the moisture that is present in the aggregates. The proportions of aggregates should be such as to give smooth and easily workable concrete. The exact amount of each aggregate required will depend to a large extent on the size and grading. Generally, the volume of fine aggregate should be about two-thirds that of coarse aggregate. This gives a slightly over-sanded mix and concrete that will place easily and produce a smooth finish. By specifying the exact amount of mixing water and allowing the contractor to work out the best mix, the architect may be assured of concrete of the desired quality.

The amount and proportions of aggregates should be adjusted so that, at all times, a plastic mix is obtained that will go into all the angles of the forms without requiring an excessive amount of spading. The mix should not be so wet that water will accumulate on the top of a layer of concrete before it hardens. All of the materials must be carefully measured so that the density of the resulting wall will be uniform.

Another factor that is of great assistance in the production of watertight and durable concrete is its proper curing. Wherever possible, concrete should be kept damp for a period of ten days or more after it has hardened. Leaving the forms in place helps to prevent the rapid evaporation of moisture from the surface of the concrete. Where practicable, the concrete should be sprinkled each day and protected as much as possible by burlap, canvas or other coverings that may be kept damp and assist in retaining moisture in the concrete.

Placing Concrete.—It is important that the concrete be evenly distributed along the forms and not allowed to flow by gravity from the point of discharge to any point on the wall. The forms should be filled evenly and, where possible, in one continuous operation. Any breaks in the placing of concrete should be made on well defined lines previously determined by the architect. In some cases it may be advisable to have all fill planes at the floor level while in others at the bottom of window openings. Concrete should be placed in the wall up to the bottom of beams and allowed to settle for a period not to exceed three hours. The beams, column capitals and floor systems are then placed. This procedure makes a real monolith of the structure.

Forms.—The forms for a building in which the monolithic enclosing walls serve as the final finish must be studied with as much care as other types of exterior treatment. The width of the form boards, the manner of finishing the exterior and the location of fill planes in reference to wall openings must all be considered as a part of the final finish of the completed structure. In other words the architectural design should be characteristic of concrete and provisions should be made in this design to take care of those features.

The surfaces that are to be left as they come from the forms must be detailed carefully. Contractors should use the best grade of tongue and groove lumber for their exterior forms. Wide boards tend to make the structure look heavy and clumsy while narrow boards dwarf the design. A 6-inch stock size is recommended. This gives an exposure to the surface of each board when assembled in the forms of approximately 5½ inches. See page 17. All boards should be of the same width and laid horizontally and level around the structure with the joints well broken. The ends of the boards should be kept in a true plane unless the architect desires to accentuate the joints. In this case the ends of the boards may be wedged out so as to produce a rugged effect.

As soon as the forms are stripped the concrete should be given a severe treatment with a wire brush so as to remove all fins and construction dirt, thus giving the surface a clean appearance. Forms should not be painted with oil or other substances as this tends to produce discoloration and prevent the bond of plaster or stucco to the wall.

Another method of producing a pleasing effect is to line the exterior face of the forms with a thin non-warping fibre board. The size and shape of the individual pieces of fibre board should be such as will produce proper rustication. The joints between the fibre boards should be covered with a small bevel

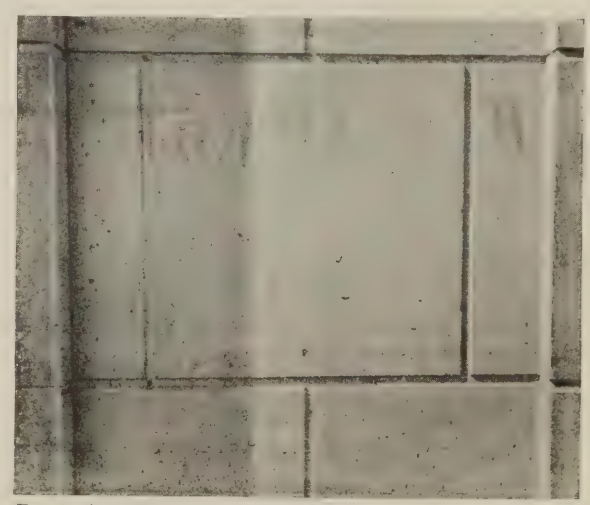

Fig. 1. Appearance of a Wall Produced With the Exterior Form Lined With a Non-Warping Fiber Board.

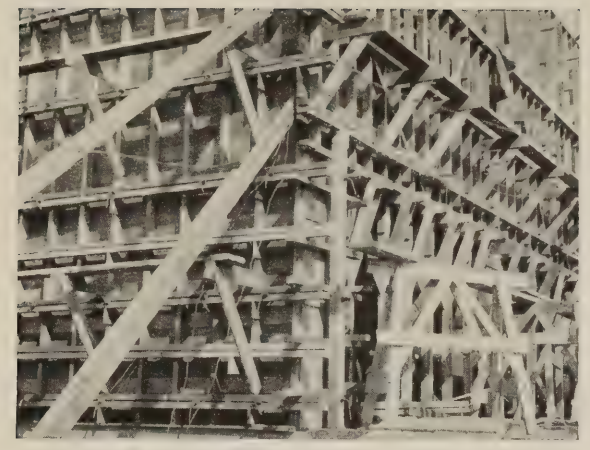

FIG. 2. ONE METHOD OF CONSTRUCTING OUTSIDE FORMS FOR MONOLITHIC WALLS.

strip to conceal all nail holes that support the lining to the form. All ties or devices for holding the forms in place should pierce this lining on the joints so that the surface of the finished wall will not be marked or patched. See Figure 1.

The erection of the forms follows a well defined plan so that the work progresses with a minimum amount of lost motion. The forms should be erected in the same manner as the framing of a house. First, 2 x 4 studs are raised on 16-inch centers and the tongue and groove lumber is nailed in place. It is recommended that only new lumber be used for the exterior face so as to eliminate unsightly spots and holes. This procedure may increase the cost of form work over the ordinary job. However, this additional cost is justified by the fact that a better surface is obtained than if the boards be used over and over again. At the same time no charge need be considered in the construction of the buildings for exterior facing material other than produced through the use of the form boards. See Figure 2.

After the exterior face form has been erected, false forms are attached to the outside wall for all windows, doors or other openings. It is not recommended to set the regular window or door frames as uncertain results may follow that will be difficult to remedy once the concrete has hardened. Figures 3 and 5 illustrate the type of form that should be used. Note the provision made in the top of these forms to take care of the contraction of the form, thus preventing diagonal cracks from forming at the corners.

After the window forms are in place the next operation is to place the reinforcing steel. The reinforcement for columns may be assembled as a cage and set into place. The wall steel is then carried directly through the column and into the wall thus making the wall and column function as a unit. Figure 5 shows a detail of the method of reinforcing the wall, as well as the placement of steel around an opening.

The next operation is to erect the inside form. This form is one story in height and may serve as the wall support for the next floor form. Concrete is then placed in this wall from the top and carefully spaded so as to fill all corners and angles of the form. The entire operation of erecting the forms is done from the inside and on the floor, thus eliminating the necessity of scaffolding.

The reinforcement for 6-inch walls usually consists of half-inch bars spaced 12 inches on centers and in the center of the wall. For an 8-inch wall two lines of half-inch bars are placed near each face with the proper amount of fireproofing over the bars. All windows, doors and other openings must be further protected with reinforcement by placing two $\frac{5}{8}$-inch bars around each window and door. These bars extend into the wall at least 30 inches on each side of the opening. Further protection is given by the use of $\frac{5}{8}$-inch bars placed diagonally or 45° over the corner of each opening. See Figure 5.

Molded Decoration.—The greatest advantage to be gained by the use of monolithic walls is the possibility of producing the architectural treatment as an integral part of the wall. By this method all exterior ornamentation is cast in the structural concrete at the same time and with the same material as used in the walls, columns and floor systems. Many of the structures illustrated in this publication show how this ornamentation has been carried out. "Waste molds" of the reverse type are assembled into the forms at the proper elevation. Before the concreting operation starts these molds are covered with a canvas to protect them from splash. After the concrete has reached a point above the center of the mold the canvas is slowly withdrawn, thus permitting the concrete to flow back against the face of the mold. Concreting operations are continued, gradually withdrawing the canvas until the mold is completely filled.

Another method of filling the waste molds is to pack them about one inch thick with a semi-dry mortar composed of one part of cement and two parts of sand and follow with the backing to be placed immediately, thus incorporating the facing with the backing. Under this procedure it is essential to use the same sand and cement for the facing as is used in the balance of the structure.

The waste molds are permitted to stay in place

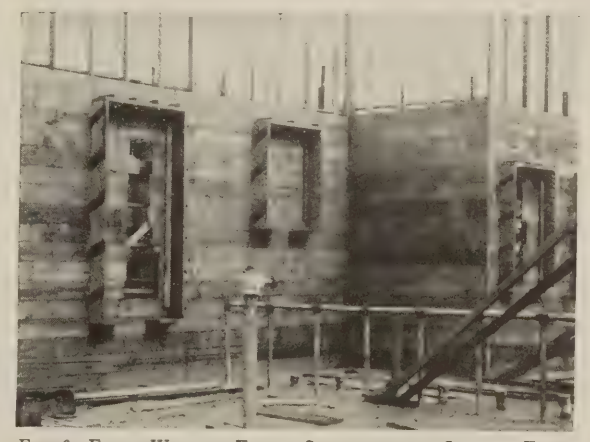

FIG. 3. FALSE WINDOW FRAME SUPPORTED BY OUTSIDE FORM. NOTE NAILING STRIPS FOR ATTACHING REGULAR WINDOW FRAME.

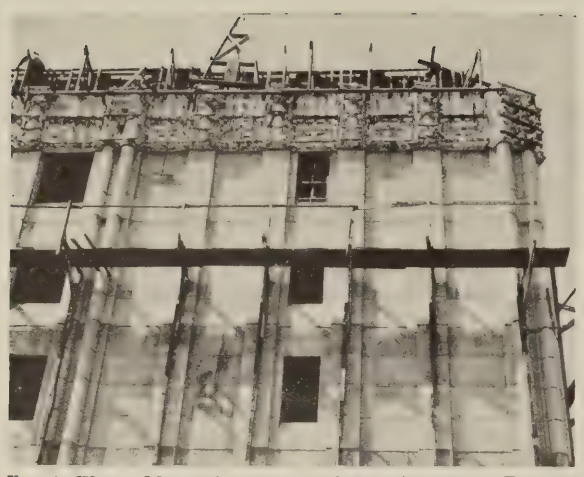

FIG. 4. WASTE MOLDS ARE LEFT IN PLACE AFTER THE FRAMES HAVE BEEN REMOVED TO CURE THE CONCRETE AND PROTECT THE ORNAMENTS.

until the building is practically completed. This has a two-fold benefit—first, it permits the concrete back of the molds to cure under almost ideal conditions. It also protects the ornamentation from damage during construction. After the building is completed the concrete will have attained a strength sufficient to permit the breaking off of the waste molds without endangering the ornamentation. The decoration may then be cleaned with wire brushes and allowed to dry out until it is uniform in color. It may then be treated with a fine dash of colored stucco or oil stain so as to produce polychrome effects.

Insulation.—Some form of insulation must be provided for this type of wall. It is uneconomical under the present knowledge of the art to cast a continuous hollow space in the wall. It is, therefore, recommended for the present at least that some form of insulation be applied to the inside of the wall before the plastering is done. Figure 8 shows a number of methods that have been used and have given satisfactory results. These consist in the use of thin, light weight masonry units in concrete, various kinds of clay and gypsum tile and the use of furring strips with metal lath and plaster. In the majority of structures the area of the wall is generally in direct proportion to the area of glass. Therefore, the form of insulation recommended will be sufficient to prevent the drop of temperature on the inside walls and also prevent condensation. Concrete and clay masonry furring units may be held to the monolithic walls by means of cement mortar, while gypsum units may be applied by means of a thin gypsum mortar.

Exterior Treatment.—The method of treating the exterior wall of monolithic buildings depends entirely upon the effect the architect desires to produce. These finishes may be defined as follows:

Surfaces which receive no treatment after the forms have been removed. See pages 16 and 23.

Surfaces similar to the above but which have been treated by grinding with carborundum. See pages 13 and 35.

Stuccos consisting of dash coats and two and three course work. See pages 26 and 40.

Each type of finish has its place and should be specified according to the effect desired.

Surfaces that are to be left as they come from the form have been previously described. The width of form board, the details as to joints should all be considered carefully both by the architects and the contractor. Immediately following the stripping of the forms the surface should be given a vigorous treatment with a wire brush to remove all dirt and fins. Should holes or honeycomb spots occur in the wall, they should be filled with the mortar from a batch of concrete exactly the same as that used in the wall. The forms should not be painted as oils may tend to produce unsightly spots in the finished structure.

The same procedure should be followed where the surface is to be ground with carborundum. Example of this is shown on page 13. It has been found by practice that it is economical to grind these surfaces so as to remove all projections and give the surface a somewhat smooth appearance. This grinding is normally done with a portable electric-driven wheel. The grinding does not remove all of the form marks but merely evens the surface.

The application of stuccos to monolithic walls

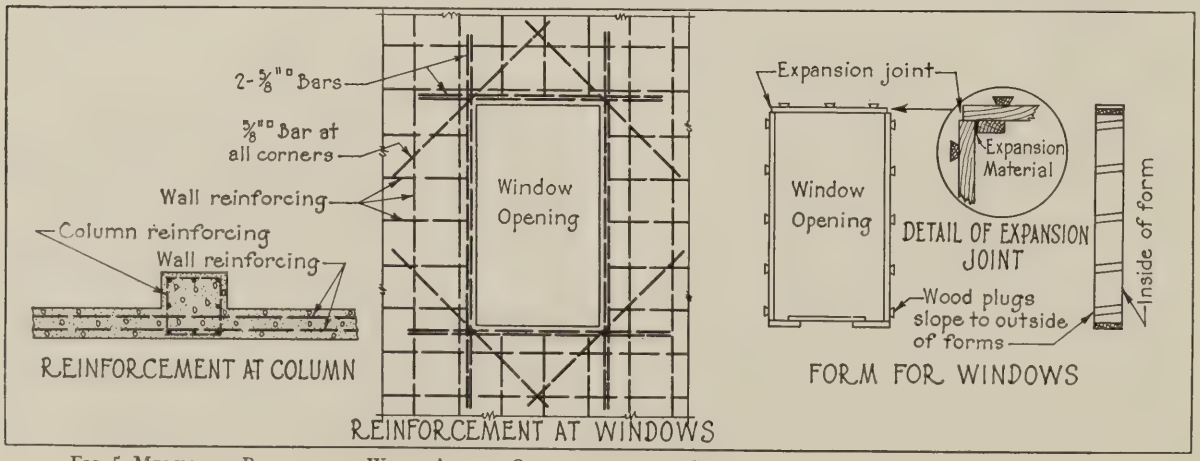

FIG. 5. METHOD OF REINFORCING WALLS AROUND OPENINGS AND THE CONSTRUCTION OF FALSE FORMS FOR WINDOWS.

makes it possible to develop a great variety of architectural effects both as to color and texture. It is recommended that the procedure given below be followed very carefully in order to provide a mechanical and physical bond between the wall and the stucco. After the concrete has hardened and cured the wall is dashed with a mixture composed of one part of cement to one and one-half parts of sand mixed to a creamy consistency. This dashing is thrown on forcibly with a dash brush and covers approximately 70 per cent of the surface of the wall. After the dashing has hardened and the wall redevelops its suction the brown and finish coats of stucco are applied. In some cases the dash coat is done in color.

Three-coat stucco work may be marked into stone effects similar to those shown in Figure 6. In the case of broken ashlar the marking of the stone is done in the brown coat. The finish coat is applied to each separate stone. These stones may be combed in different directions to produce mottled effects or slight changes in color of the finish coat and may be used to produce unusual effects.

Special processes embodying the use of exposed aggregate finishes may also be applied to monolithic walls. Colored effects are produced by means of the color in the aggregates embodied in the finish coat and exposed by means of a muriatic acid wash after the concrete has hardened.

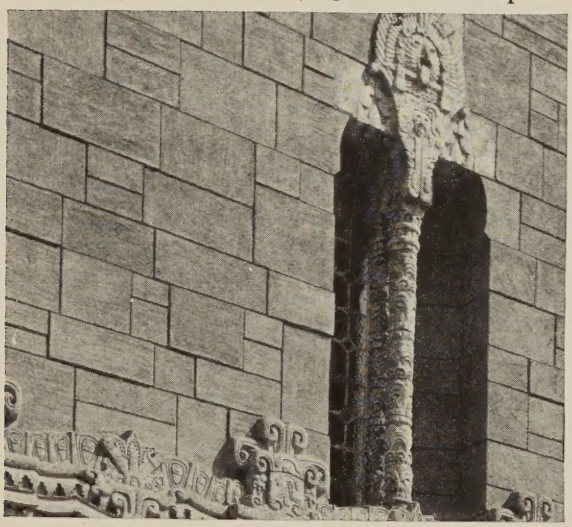

FIG. 6. COLORED STUCCO MARKED INTO BROKEN ASHLAR. ORNAMENT CAST IN PLACE CONCRETE.

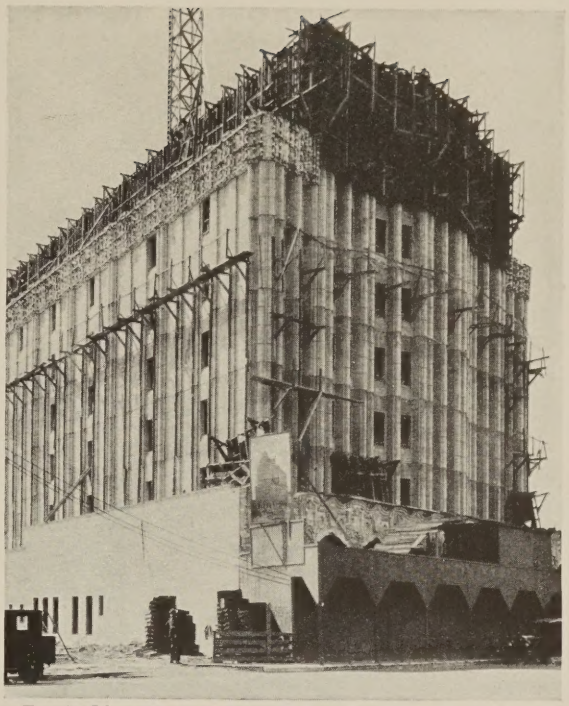

FIG. 7. MONOLITHIC WALLS UNDER CONSTRUCTION. NOTE WASTE MOLDS IN PLACE AT OFF-SET.

Scratch and brown coats may be applied to monolithic walls by means of the cement gun. Past experience in this method of application indicates that it is almost impossible to obtain an even color over the structure where a finish coat in color is applied with the cement gun. If mottled effects are desired, a color coat may be put on with this method. This type of construction has been used quite extensively throughout the country and on large structures has proven not only satisfactory but an economical means of producing a pleasing exterior.

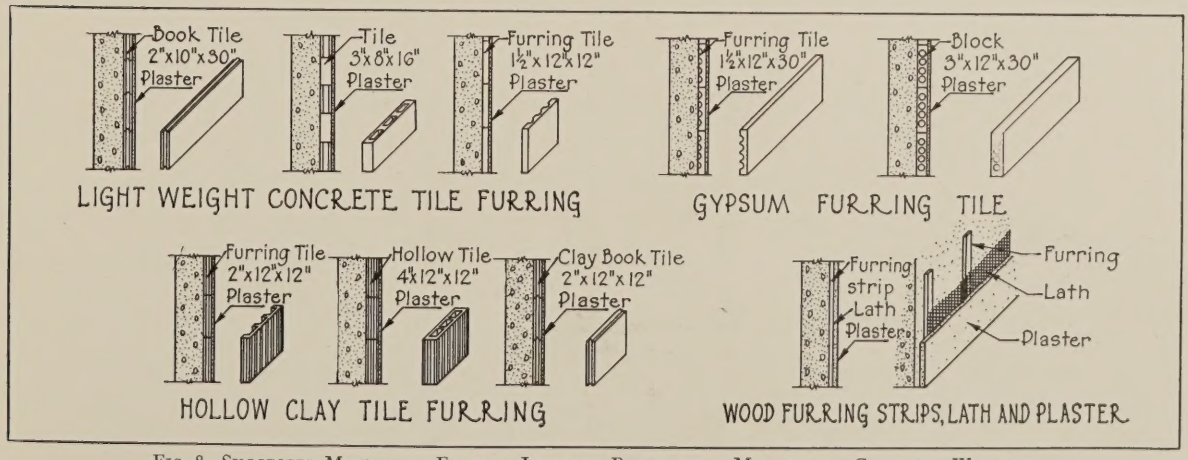

FIG. 8. SUGGESTED METHOD OF FURRING INTERIOR PLASTER FOR MONOLITHIC CONCRETE WALLS.

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